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CONSERVING OUR SOIL RESOURCES

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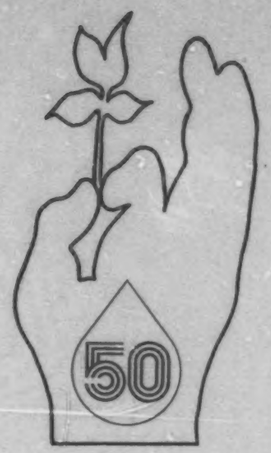

KANSAS
APRIL 1985

This material was developed for use by elementary teachers for conservation education as well as other classroom activities.

The following three lessons help students understand what soil is and how it affects their lives. Each lesson contains activities which can be used in a classroom setting. A wide range of activities allows teachers to select activities for variation in student and class abilities. At the end of each lesson is a list of other disciplines which could be used to supplement these activities.

USDA-SCS
Salina, Kansas

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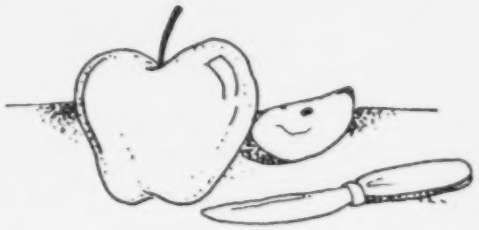
INTRODUCTION

Background:

One of the most important natural resources that covers much of the earth's land surface is soil. All living things depend on it as a source of food, either directly or indirectly.

Our food producing land remains the same and yet the world population continues to grow. Consequently, each person's food portion becomes smaller and smaller. It is the responsibility of each generation to use the soil wisely to insure the future. The following demonstration will show how little of the earth's surface is actually used for food production as compared to growing populations.



Materials:

Large apple (softer apples work better)
Paring knife (or heavy plastic knife)

Procedures:

1. Cut the apple into four equal parts. Three parts represent the oceans of the world. The fourth part represents the land area.

2. Cut the land section in half lengthwise. Now you have two one-eighth pieces. One section represents land such as deserts, swamps, antarctic, arctic, and mountain regions. The other one-eighth section represents land where man can live but may not grow food.

3. Slice this one-eighth section crosswise into four equal parts. Three of these one thirty-second sections represent the areas of the world which are too rocky, too wet, too hot, or where soils are too poor for production, as well as areas developed by man.

4. Carefully peel the last one thirty-second section. This small bit of peeling represents the soil of our earth on which mankind depends for food production!

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Lesson 1 - What Is Soil and How Is It Formed?

OBJECTIVE:

To understand the various components of soil and how they are formed.

Activity 1: Making Soil and Rock

Background:

Soil is formed from rocks very slowly being broken down by acts of nature and climate.

When you rub two rocks together, small particles rub off. It takes a long time to accumulate even a spoonful. When large sheets of ice (glaciers) moved over the land thousands of years ago, they ground rocks together, rubbing off tremendous quantities of rock particles of all sizes. Much of the north central United States is made up of soils that were formed by the action of these glaciers.

Changes in temperature also help to make soil. The sun warms the rocks during the day. At night the rocks cool. The expansion and contraction chips off particles of rock.

Freezing water expands with tremendous force. Water that finds its way into cracks in the rocks freezes and breaks the rocks into smaller and smaller pieces.

Most of the soils we see today developed from rock material that was moved by water or wind either after this "weathering process" or while it was going on.

Soils are also formed as rocks are rolled along by streams. Examine the smooth pebbles you see on beaches and along streams. They have been rubbed together until the rough parts are knocked off. These rubbed-off particles make up soil as they are deposited in some flood plain or at the bottom of a lake.

Since the lime in limestone is soluble, it gradually washes away leaving only the other materials as soil. It takes 40 to 50 feet of limestone to make only a few inches of soil.

There are other physical and chemical factors that also aid in soil formation. For example, wind blows small rock particles against larger ones, wearing both down.

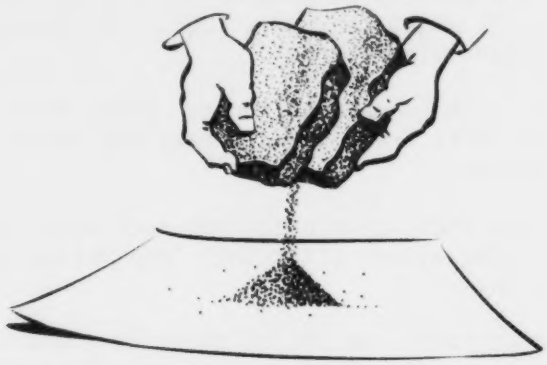
Materials:

Two pieces limestone or sandstone
Sand
Chalk (two pieces)
Window screen
Hammer
Safety glasses
Small piece of cloth
Paper cup

Procedures:

Students can show how some of the forces of nature break down rocks into soil material by a simple demonstration:

Rub two pieces of limestone or fine sandstone together. If you do not have natural stone, pieces of building bricks or concrete will do. Notice how long it takes to rub off even a few fine particles.



You can now make this same sandstone rock.

1. Pour some sand through the window screen and collect the grains that fall through. Now wrap the chalk in a piece of cloth and crush it with a hammer.

2. Place one spoonful of chalk and five spoonfuls of sand in a bowl and mix thoroughly. Add a small amount of water to the mixture and stir until it becomes a paste.

3. Pack the mixture tightly into the bottom of a paper cup.

4. Let the mixture dry for at least 24 hours. After it is dry, tear away the paper cup. You have made a sandstone rock.

Lesson 1 - What Is Soil and How Is It Formed?

Activity 2: Making Different Soil

Background:

Soil scientists classify soil particles into sand, silt, and clay. Starting with the finest, clay particles are smaller than 0.002 millimeter in diameter. Some are so small that ordinary microscopes do not show them. Clay texture feels smooth, plastic, and very sticky. Silt particles are from 0.002 to 0.05 millimeter in diameter.

Silt texture feels smooth and slick, or flour like. Sand ranges from 0.05 to 2.0 millimeters. Particles larger than 2.0 millimeters are called gravel or stones. The relative size of the three soil particles can be demonstrated with a basketball, a baseball, and a BB.

Most soils, as found in nature, contain a mixture of sand, silt, and clay in different proportions.

Size of soil particles is important. The amount of open space between the particles has a lot to do with how easily water moves through a soil and how much water it will hold.

Too much clay, in proportion to silt and sand, causes a soil to take in water very slowly. Such a soil also gives up its water to plants slowly. These soils are sticky when wet.

Loam and silt loam refer to soils that have a favorable proportion of sand, silt, and clay. The makeup of soil is important as it affects the ease of working the soil, what crops can be grown, and the stability of buildings.

Materials:

Texture chart
Six cups each:
- Clay - (obtain from hobby shop or clay soil area or commercial bentonite)*
- Sand - (obtain from lumber yard or sand company)*
- Silt - (obtain from overflow of flood area or any area where soil has been recently deposited by water)*

Foam cups
Commercial potting soil

*Your local Soil Conservation Service office may be able to help you obtain soil materials.

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Procedures:

Students will make different soils by combining various percentages of sand, silt, and clay.

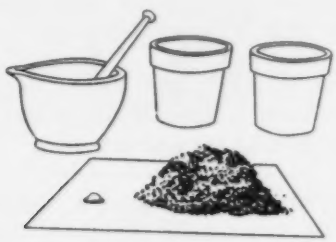
1. Assign student groups to make the various soils by putting together the correct ratios of sand, silt, and clay. Circles on the chart indicate recommended mixtures. Students' math should be checked before making the soil.

2. Each group should make enough of their particular soil to fill an 8-ounce foam cup.

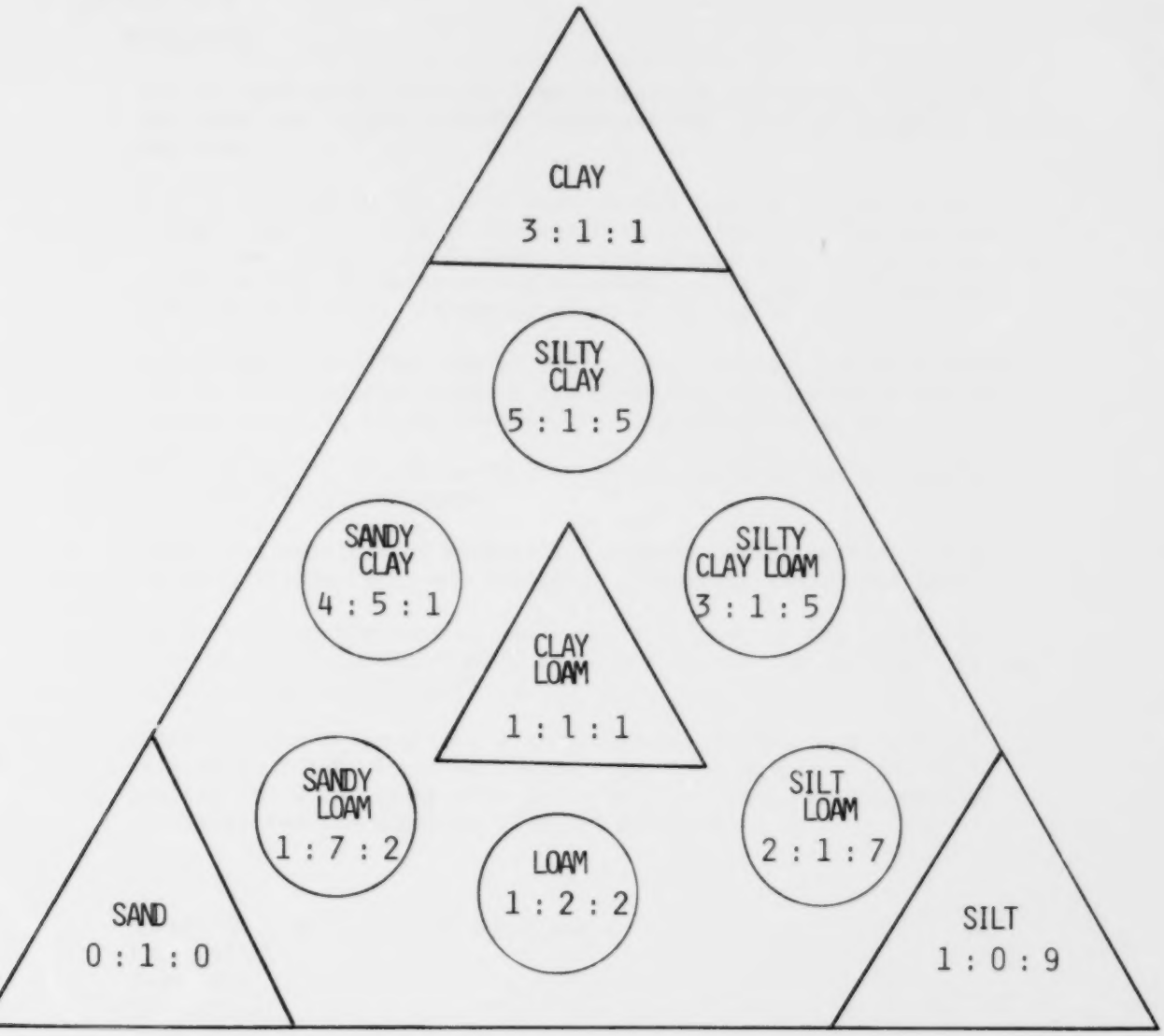
3. Before the soil is put into the cup, it should be mixed thoroughly in a separate container, and the cup labeled as to the soil name.

4. One cup will be filled with a commercial potting soil.

5. Have the students do Lesson 3, Activity 1, and observe how different types of soil affect plant growth.



TEXTURE CHART



RATIOS ARE PARTS CLAY : SAND : SILT

Lesson 1 - What Is Soil and How Is It Formed?

Activity 3: What's in Soil?

Background:

Soil is continuous over the land surface of the earth, except for the steep and rugged mountain peaks and the lands of perpetual ice and snow.

Soil is related to the earth much as the rind is related to an orange. But this rind of the earth is far less uniform than the rind of an orange. It is deep in some places and shallow in others. It may be red, as soils are in Oklahoma, or it may be black, as some are in Kansas. It may be sand, or it may be clay.

Be it deep or shallow, red or black, sand or clay, the soil is the link between the rock core of the earth and the living things on its surface. It is the foothold for the plants we grow.

The soil mantle of the earth is far from uniform, but all soils have some things in common.

Every soil consists of mineral and organic matter, water, and air. The proportions vary, but the major components remain the same.

Every soil occupies space. As a small segment of the earth, it extends down into the planet, as well as, over its surface. It has length, breadth, and depth.

Every soil has a profile - a succession of layers in a vertical section down into loose weathered rock. The nature of the soil profile has a lot to do with the growth of roots, the storage of moisture, and the supplies of plant nutrients.

Materials:

Bucket of good soil with humus and earthworms
Paper plates
Hand lens
Microscopes
Water bottles
Soil Testing Kit (Optional)
Sieves

Procedures:

Student is asked to define soil after he or she has examined it.

1. Each student takes a plate of soil with humus and earthworm.

2. Examine and list all items found in soil sample.

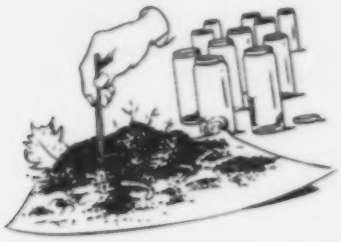
Activity 3: (cont.)

3. Describe texture and color of soil.

4. Mix small amount of sample with water, put on slide, and examine under microscope.

5. Use available equipment and develop one or two tests on soil of your own idea.

6. Define soil.



Lesson 1 - What Is Soil and How Is It Formed?

Activity 4: What Kind of Soil Do I Have?

Background:

The physical properties of a soil largely determine the ways in which it can be used. Important physical properties depend on the size, shape, arrangement, and mineral composition of its particles and the volume and form of its pores.

The flow and storage of water, the movement of air, and the ability of the soil to supply nutrients to plants are examples of properties determined by the size and arrangement of the soil particles.

The proportions of the four major components of soils - inorganic particles, organic material, water, and air - vary greatly from place to place and with depth. The amount of water and air in a soil often fluctuates widely from season to season. The physical characteristics of the primary solid components of soil, however, are essentially unchanging. (See Activity 1)

Mineral inorganic soil particles occupy about one-half of the total volume of most surface soils. Some of the particles can be seen very easily, but others can be examined only with an electron microscope. For many purposes, it is convenient to divide the particles into size groups.

Particles more than 2.0 millimeters in diameter are classed as gravel or stones and are not usually included in analyses of particle size. Particles under 2.0 millimeters are divided into three major groups.

Sand has particles between 0.05 and 2.0 millimeters in diameter. The percentage of sand is determined by screening a thoroughly dispersed soil.

Silt has particles of 0.002 to 0.05 millimeter in size. Clay has particles less than 0.002 millimeter in diameter. The amount of silt and clay usually is determined indirectly from measurements of the speed of fall of the individual particles which have been well dispersed in water. The size of the individual particles is calculated from the settling speed.

The percentages of sand, silt, and clay in a soil determine the texture of the soil.

Materials:

Samples of clay, silt, and sand soil material
Water bottle
Balls of various sizes (basketball, softball, baseball, tennis ball, golf ball, marble, and BB's)
Soil from the school yard or adjacent areas

Procedures:

1. Give each ball to a student and then ask which ones are the relative sizes of sand, silt, and clay particles.

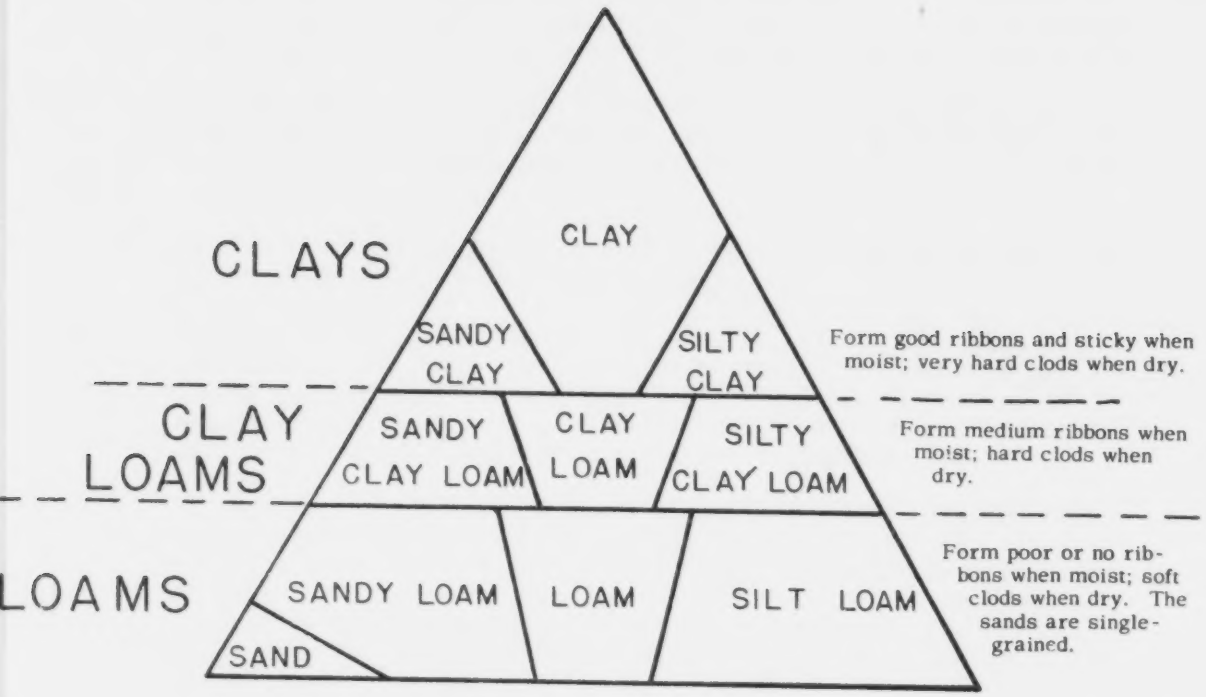
Answer - Sand - basketball
Silt - baseball
Clay - BB

2. Give each student a sample of the three kinds of soil material.

Do a ribbon test on each soil material. To do this place about ½ to 1 teaspoon of soil in the palm of the hand. Add water very slowly, drop by drop, from a water bottle or tap. Knead the soil all the while and bring it to the consistency of moist, workable putty. When the soil is at the proper consistency, try to press it into a ribbon between the thumb and forefinger.

Sandy Soil Material - Doesn't make a ribbon when moist; soft clods or single grains when dry.
Silt Material - Very little ribbon; clods when dry
Clay Material - Forms good ribbons and sticky when moist; very hard clods when dry

3. Give each student a small amount of a soil sample from the school yard or an adjacent area. Using the ribbon test and knowledge from Activity 2, determine your type of soil. Use the attached chart for guidance.



Once it has been determined whether it is a clay, clay loam, or loam; reexamine the sample. If it is definitely sandy, call it a sandy clay, a sandy clay loam, or a sandy loam, depending on the type of ribbon it made. If it is exceptionally smooth, call it a silty clay, silty clay loam, or silt loam. If it is neither, rather sandy or exceptionally smooth feeling, call it a clay, a clay loam, or a loam, depending on the type of ribbon produced.

Soils that are loose and single grained when dry and form a fragile cast when moist are called sand.

Lesson 1 - What Is Soil and How Is It Formed?

Activity 5: Organic Matter

Background:

Soil organic matter is a substance and process. It is a mixture of materials, plant and animal remains, and products of decay processes that have been going on for months or years.

Organic matter is produced in living organisms and is composed of a great many compounds of carbon. In soils it occurs as a mixture with inorganic soil parts, which are derived from rocks and minerals.

Most of the organic matter in soil is due to the never-ending decomposition of plant and animal residues. Through decomposition, organic matter is converted into simple compounds, such as carbon dioxide, water, and nitrate.

The term "humus" often is applied to organic material which is in an advanced stage of the decay process.

Whenever plants grow, their roots, leaves, stems, and twigs are the raw material for the organic-matter process. All the intermediate substances between them and the simple end products make up the organic fraction of soils. A small part of the organic matter is the living cells of such microorganisms as bacteria and molds.

The chemical activities of these bacteria and molds are far more important than their abundance might lead us to believe. Their most important basic function is to destroy complex organic materials. If organic matter were an end product rather than an intermediate product in the biochemical factory of the soil, all the carbon dioxide in the atmosphere would be tied up sooner or later in the organic matter in the soil.

The rate of decomposition is dependent upon temperature, oxygen, and the amount and kind of organic matter. Whenever fresh residues are applied, the decomposition of "humified" materials already present is speeded up, so that complete turnover of the organic matter eventually occurs.

Materials:

Baby food jars for each person
Bucket of commercial garden mix
Bucket of organic material (manure, compost, or leaf mold)
Bottle of alum
Water container
Paper cups

Activity 5: (cont.)

Procedures:

A. COLLECTING SOIL

1. Show the commercial soil mix to your students, and tell them that it is an excellent soil for growing vegetables and other plants.

2. Divide the group into two or more teams and give each team a paper cup.

3. Challenge the teams to find soil at home or near the school as similar to the commercial mix as possible and to bring back a handful in a paper cup.

4. When everyone has a soil sample, ask the students to compare the color, smell, and feel of the commercial mix with their own samples.

B. MAKING THE ALUM TEST

1. Introduce the alum test as another way of comparing soil samples. Use the commercial mix to demonstrate the test.

a. Fill a baby food jar one-fourth full with the soil to be tested. Add a large pinch of alum. Alum will make the organic material separate from the soil.

b. Fill the jar with water, cover tightly with lid, and shake the jar vigorously.

c. Let the material in the jar settle at least one minute. Be careful not to disturb the jar.

2. Distribute the jars and ask the teams to make "alum profiles" of the soil samples they collected at the site.

3. Have the students compare the contents of their jars with the contents of the commercial-mix jar. Are the colors similar? Are the same layers of material visible in both jars? If the students don't notice, point out that the top layer of floating material in the jar of commercial mix is much larger than the top layer in their soil-sample jar. Identify this top layer as the organic matter present in the soil. Tell the students what organic matter is, and explain its importance to the soil.

Lesson 1 - What Is Soil and How Is It Formed?

Activity 6: Decomposition

Background:

In the soil, organic matter is continually added, decomposed, and finally mineralized returning elements to the nutrient cycle. This is a dynamic or ever changing process that affects soil formation.

Organisms in the soil such as millipedes, earthworms, and grasshoppers eat fresh organic material and leave partially decomposed matter as excreta. Microorganisms such as bacteria and fungi provide further decomposition into a variety of organic compounds including protein, fats, and carbohydrates. In a process called mineralization, these compounds are finally broken down into simple products like carbon dioxide, water, and salts.

This organic matter makes up the uppermost part of the soil profile and is the location of major biological activity associated with soil formation.

Materials:

Paper cups (or other containers) for collecting soil
Newspapers to spread soil samples on
Something to dig with (sticks, spoons, or trowels)
Paper for recording, rulers, string, poster paper with marker, and easel
A pile of leaves, if available

Procedures:

Students will study the decomposition of plants and animals into soil nutrients.

To create interest in this activity, bring in a piece of fruit or vegetable, or other plant. Stimulate student thinking by holding it up and asking:

"What does this plant need to grow?
What does this plant use for food?
How does a plant eat?
How does a plant get its food?
Where does it store its food?"

1. Introduce the word nutrients. Discuss their significance as "foods that provide energy and nourishment." (Optional - look up the word and find related words.)

Then lead a discussion:

"What things can be used as nutrients?
How do nutrients get into the soil?
What is meant by the term 'soluble'?"

Activity 6: (cont.)

If the students need more specific leading questions, ask:

"What happens when plants and/or animals die?
What things have you seen decomposing? (The word decomposing can be defined using a dictionary, or just as 'rotting'.)
What happens when organisms decompose?"

2. Ask the children if they know what happens to a leaf when it falls to the ground. Ask the children if they have ever looked under a pile of leaves. Ask the children to examine a pile of leaves, if available. Are they wet or dry? Push the top leaves aside carefully and ask the children to look closely. Ask them how the leaves are different. Show the children a handful of soil from the bottom. Ask them to look for bits of leaves. Do they know dead leaves turn into soil? Explain how it provides food for new green plants to grow.

a. Do you see bugs or worms? Explain that they eat the dead leaves.

b. Do you know what happens when all the leaves break down into soil?

c. Using a green leaf and dead leaf, ask the children to compare them, pointing out the differences. Using the leaf coloring sheets (Attachments 1 and 2), ask the children to color the leaves appropriately.

3. Take the class outside and give these directions:

"With one or two other people measure off a square foot (or a metric measurement). Study your plot, using as many of your senses as you can, and record your findings on the task card."

Note: (If the teacher wishes to introduce some math skills at this point, the measuring cups can be used to dig up a particular amount - cup or metric unit - of soil for examination.)

Allow time for students to investigate, then discuss:

"What did you find in your soil?
What material could decompose?
What material could not decompose?
What will happen to material that will not decompose?
What effects do these materials have on soil? On plants? On animals? On people?"

Prepare the class for a small group discussion by saying, "In groups of four or five people, talk about, and come back with some ideas on what we can do to improve soil as a class and/or as individuals." Have groups make suggestions and discuss as a class.

Activity 6:

Attachment 1

Activity 6:

Attachment 2

HANDOUT 1

A Profile on Soil

Dig down a few feet (not here!) and you'll discover what soil scientisis term "a soil profile."

It's those layers of soil down to loose weathered rock. The layers may be as thin as a fraction of an inch—or as thick as several feet.

The profile is important to know—to farmers growing crops, to gardeners raising vegetables, to land owners building houses. Soils can be impermeable to roots and water. They can be unstable. They can be shallow.

Most soil profiles have three major horizons—

Topsoil is the top layer. Life is most abundant here. Food crops thrive in it. You'll find plant roots, bacteria, fungi, and small animals.

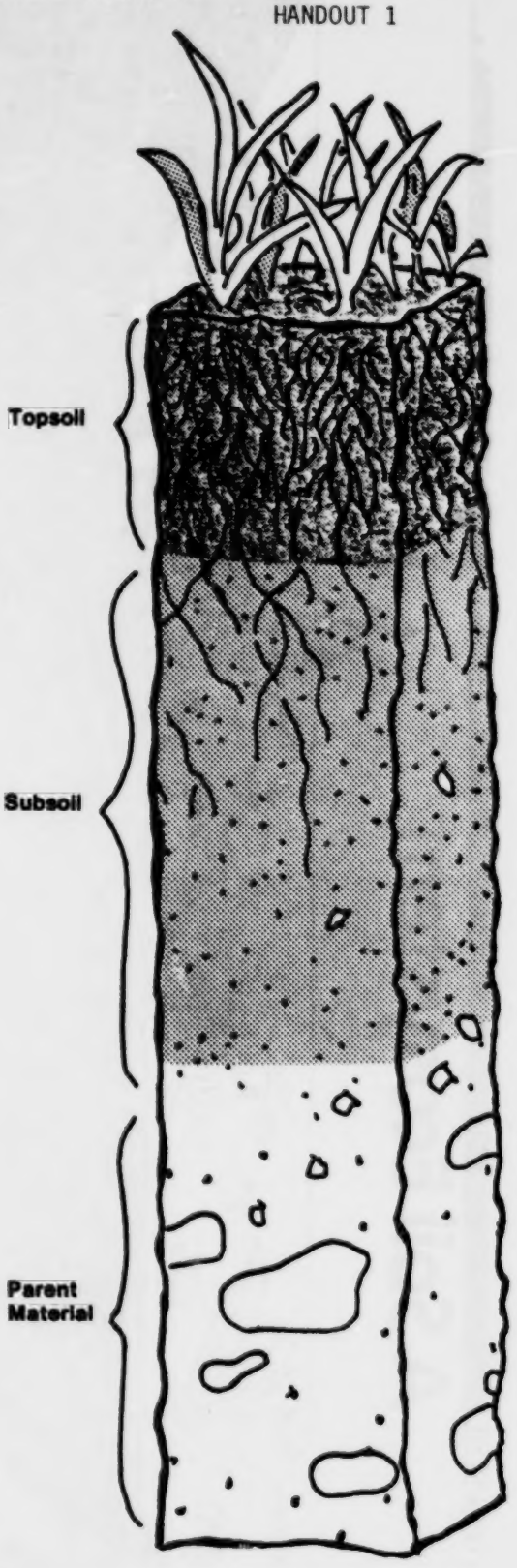
Subsoil has fewer organisms than the topsoil above it. Plants don't grow well in it. Subsoil is generally harder when it's dry—and stickier when it's wet—than the soil above or below it.

Parent material gets its name because its rock material is the same as most of the soil above it. It has less living matter than the layers above.

To the soil scientist, the soil profile is a record of what has happened to that soil since it began to form. That information is invaluable in determining the potentials and limitations of soils for everything from growing wheat to controlling soil erosion.

On its own, soil "grows" from parent material at about the rate of an inch every 100 to 600 years. But erosion from water or wind can remove that much in a single year. What's eventually left is a subsoil that's difficult to cultivate...and much less productive.

That's why USDA provides technical and financial assistance to farmers for soil conservation. Such practices as contour stripcropping and terraces help keep soil "fit" for food production today...and for generations to come.



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CONSERVING SOIL

A Soil Ecosystem

Attachment 1

Lesson 1 - What Is Soil and How Is It Formed?

Discussion and Questions

1. Does the soil type affect how plants will grow in it?

2. Does the soil type change the amount of water needed to grow a plant?

3. Which soils and crops would benefit most from irrigation or extra water?

4. Where could you obtain a map which shows the different soils in your community? A soil survey is available at the local Soil Conservation Service office in most counties.

5. How would the addition of organic material affect the soils you made in Activity 2?

6. What biological components are usually in soil? (Worms, microorganisms, plants) Use Attachment 3 to show that a soil profile changes from parent material up to a surface with more organic material.

7. What part does organic matter play in the production of soil?

8. How does the amount of organic material in soil relate to what will grow on the soil?

9. In what layer of the soil profile is most organic material found?

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Lesson 1 - What Is Soil and How Is It Formed?

Incorporating Disciplines:

The following suggestions may provide additional activities:

Art

Sand art
Clay sculpture
Painting with soils

Math

Statistical counting and plotting the frequency of soil particles.
Graphing volume and weight ratios.

Language

Readings on the formation of land masses.
Write a narrative of a particular soil.

Social Studies

Study of how soil types affect land use and urban buildup.

Industrial Arts

Study of bricks, clay tile, etc.
Study of glassmaking.

Music

Research on materials used in making instruments (jugs, sand blocks, glass).

Health or Physical Education

Study the use of sand and clay in sports (clay courts, long jump pits, ski slopes).

Home Economics

Study of products from clay (china and pottery).
Study of blowing glass containers.
Landscaping and soil types around homes.
House plants and soil types.

Science

Decomposition of organic material by organisms.
Pressure involved in cracking rock with freezing water.
Combination of carbonic acid and limestone in weathering.

Lesson 2 - Soil Erosion

OBJECTIVE:

Students will see the two major ways in which soil is lost and several ways which it could be protected.

Activity 1: Sheet and Rill Erosion

Background:

As water rushes off bare soil, it takes soil particles with it. The quality of the runoff water is determined by what protection is on the soil surface. The water from the bare soil is muddy while the one which had plant materials on it is considerably cleaner.

Erosion is a selective process by which the finer and more fertile soil elements are lost first. The soil surface is generally the richest part of the soil.

Ask students to brainstorm reasons why erosion is a serious economic factor. List the reasons on the board. Students should realize that soil erosion is serious and has an impact on all of us. Obvious impacts should be the cost of dredging silt from rivers and harbors, washing out roads and ditches, and flooding of cities and towns. This would increase taxes. In addition, food costs could rise since eroded soils are less productive.

Emphasize the fact that 6.4 billion tons of soil are eroded from U.S. land each year. This amount of soil would fill 320 million dump trucks if each truck carried 20 tons of soil. If these trucks were parked end-to-end and were 25 feet long, they would extend to the moon and three-quarters of the way back.

Describe the three types of erosion caused by moving water and have your students fill in the chart. (See Handout 1) Then ask your students to search for examples of erosion in their community and answer the remaining questions. If this is not possible, you could take photographs using slide film and project the slides in class. (You could also search for examples on the school grounds or contact the local Soil Conservation Service office.)

You can demonstrate the types of erosion in the classroom in a stream pan. Sprinkle water down the sloped stream pan. Controlling the amount of water and the slope by trial and error, all three types of soil erosion can be demonstrated. Demonstrate the effect of slope and vegetation on erosion.

Activity 1: (cont.)

Materials:

2 aluminum, disposable, baking pans (turkey size)
1 watering can or sprinkler can (2 would be better)
2 quart jars
Enough soil to fill each pan halfway (soil could be from schoolyard, field, etc.)
Plastic drop cloth
Residue material - (use one or any combination of) grass clippings, leaves, straw
Several small coins (quarters) or small flat stones

Procedures:

1. Cut a "V" notch at one end of pans approximately one-half the depth of the pan.

2. Fill both pans at least one-half full of soil, spread evenly.

3. To one pan add the residue material and spread evenly over the entire surface.

4. Place several coins or stones on the bare soil surface and residue surface.

5. Place pans on a table so that notches extend over the edge.

6. Elevate one end of pans so that water will run out of notches.

7. Place empty jars on chairs below notches.

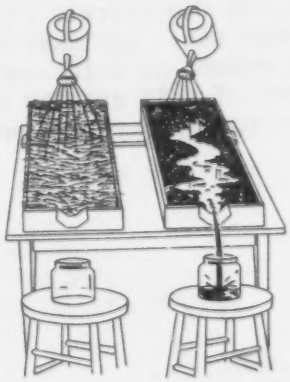
8. Fill sprinkler can with one quart of water and pour steadily on both pans at the same time and at the same rate. Hold sprinklers about one foot above the pans.

9. Observe results -

   a. Effects on soil surface (around coins).

   b. Quality of water in jars.

   c. Amount of water in jars.



Lesson 2 - Soil Erosion

Activity 2: Wind Erosion

Background:

Wind plays a role in soil erosion. Some soils are more prone to wind erosion than others. Residue again plays an important part in protection from the wind, and windbreaks will help reduce wind erosion damages.

Materials:

Aluminum disposable baking pan (turkey size)
Variable-speed fan
Plastic drop cloth
Enough oven-dried sand to cover base of pans, small cedar or juniper branches (two- to three-inches long); make as thick as possible

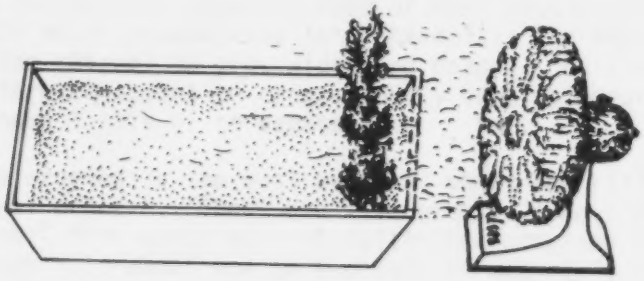
Procedures:

1. Place the drop cloth on the floor with the pan filled with dry sand at one end. Locate the fan 6 to 24 inches away (dependent on the size of fan) so the direction of air flow is over the drop cloth.

2. Turn on fan at varying speeds. Observe effects on the soil (sand).

3. Replace sand in pan and place cedar or juniper twigs along the windward end of pan to form miniature windbreak (see sketch).

4. Turn on fan at varying speeds. Observe effects - compare to step two.



Discussion and Questions:

1. Can students identify local areas where erosion has occurred or the results of erosion can be seen?

2. Have students consider various types of protection for the soil in an urban area (i.e., what about a construction site or new house?).

3. Use Handouts 1 and 2 to stimulate discussion and questions.

Attachment 1

Lesson 2

SOIL EROSION: How It Occurs, Part 1

Erosion is the process which moves soil from one location to another by wind, water, or other natural action. It is a natural process until accelerated by our actions. It has several harmful effects. Farmers harvest a smaller crop per acre, fields become less productive if large gullies develop, and silt from eroded soil builds up in our waterways, causing more frequent flooding and higher costs for navigation. Costly dredging is often required to correct silt problems.

It is usually easy to find evidence of soil erosion that is caused by moving water; soil scientists have identified three types: sheet, rill and gully.

Sheet Erosion

Sheet erosion is the most difficult to see. It is the gradual wearing away of a thin, uniform layer (or sheet) of soil. There are no channels formed by the moving water. Sheet erosion occurs where there is not enough vegetation covering the soil to stop erosion completely, yet there is enough cover to prevent rill erosion. It is seen as muddy runoff water.

Rill Erosion

This type of erosion occurs on slopes where the runoff water accumulates into small channels. Rill erosion can be seen as many small channels of a few inches depth. Yet the channels are not large enough to interfere with the movement of farm equipment. Rill erosion occurs on slopes that are gentle or have little protective vegetation.

Gully Erosion

Gully erosion is the most dramatic form of soil erosion. Gullies form when the runoff water accumulates into channels. The rapidly moving water causes the channel to grow wider and deeper. Gullies may become too deep for farm equipment to cross. Gully erosion occurs on steeper slopes which have little or no vegetation.

Although gully erosion is the most evident, sheet and rill erosion are a greater national concern. Sheet and rill erosion remove an average of five tons of soil from every acre of cultivated cropland each year. (A pickup truck can hold about one to two tons of material, and an acre is about the size of a football field.)

In this activity, students search for examples of sheet, rill, and gully erosion in their communities. They tell why it occurs and how it can be reduced.

Additional Activity

Create a classroom display of sheet, rill, and gully erosion. Use three shallow, plastic-lined boxes filled with local soils. Fill the boxes with soil and appropriately mold the soil to illustrate the three forms of erosion.

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Lesson 2

SOIL EROSION: How It Occurs, Part 2

In addition to sheet, rill, and gully erosion by water, soils are eroded two other ways. Wind erosion and land slippage also cause soils to move from one location to another.

Most wind erosion occurs in areas of high prevailing wind speeds and low annual rainfall. The soils have a smooth surface and are composed of particles that are easily moved by the wind. In addition, there is limited vegetation cover. Wind erosion is a particular worry on the Plains, where these conditions may exist over large areas of cropland and rangeland. For example, in Texas, which has the greatest land area subject to wind erosion, this area is larger than the total combined areas of Ohio, Indiana, Illinois, and Iowa.

A good way to control wind erosion is to plant a cover crop or windbreak that decreases the speed of the wind at the soil surface. Windbreaks can be rows of evergreen trees planted at a perpendicular angle to the wind, narrow bands of tall grasses, or grasses planted in fields instead of row crops.

Land slippage refers to blocks of saturated soil moving down slopes in response to gravity. It is usually seen as a cave-in of a cliff or bluff that overhangs a river or stream. Land slippage can also be seen as small landslides or mudslides along steep road embankments. The famous mudslides of southern California that damage homes and roads are recurring examples of land slippage. Less evident examples can be seen along cultivated fields. Blocks of soil tend to creep down slopes during the winter from frequent freezing and thawing.

In this activity, students identify local wind erosion and land slippage problems. In addition, they rank their impression of the soil erosion damage in their community.

Lesson 2 - Soil Erosion

Incorporating Disciplines:

The following suggestions may provide additional activities:

Math

Determining linear measurements, weight, and volume graphing ratios or percentages.

Language

Writing descriptive sentences, write a narrative about soil (describe your life as a drop of water on its way to the river or ocean).

Social Studies

Study of land use, cost of erosion to society.

Art

Sand art
Clay sculpture

Shop/Industrial Arts

Study of bricks, clay pipe, etc.

History

Conditions when Lewis and Clark and Coronado visited Kansas.

Lesson 2

SOIL EROSION
How It Occurs

Erosion occurs when the soil is moved from one place to another by moving water or wind. Three types of erosion are caused by moving water: sheet, rill, and gully erosion. Your teacher will describe the differences between the types. Use that information to fill in this chart.

Type of Erosion	Description	Causes
Sheet		
Rill		
Gully		

Circle the correct answer for each of the following questions:

1. Sheet erosion is more/less obvious than rill erosion?

2. Sheet erosion is more likely to occur on flatter land than steeper land? True or False

3. Rill erosion is more/less obvious than gully erosion?

4. Rill erosion on bare soil can be reduced by:

   a. Planting grass
   b. Making rows up and down the hill
   c. Covering the soil with some kind of plant residues
   d. Both a. and c.

5. Gully erosion is a severe problem on flat land? True or False

6. Gully erosion does not have much effect on the quality of water? True or False

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Lesson 2

SOIL EROSION
How It Occurs

Erosion occurs when the soil is moved from one place to another by moving water or wind. Three types of erosion are caused by moving water: sheet, rill, and gully erosion. Your teacher will describe the differences between the types. Use that information to fill in this chart.

Type of Erosion	Description	Causes
Sheet	Removal of very thin layers of soil.	Generally occurs on flatter slopes with little or no protection (conservation) with frequent, gentle rainfall.
Rill	Miniature "valley". Generally no larger than 6"-8" and 4"-6" deep.	Water concentrates in small depressions where there is greater slope to the land.
Gully	Large "valley" from 1' top width and 1' deep and larger.	Usually a large quantity of water is forced through a small area. Slopes could be gentle to steep.

Circle the correct answer for each of the following questions:

1. Sheet erosion is more/(less) obvious than rill erosion?

2. Sheet erosion is more likely to occur on flatter land than steeper land? (True) or False

3. Rill erosion is more/(less) obvious than gully erosion?

4. Rill erosion on bare soil can be reduced by:

   a. Planting grass
   b. Making rows up and down the hill
   c. Covering the soil with some kind of plant residues
   (d.) Both a. and c.

5. Gully erosion is a severe problem on flat land? True or (False)

6. Gully erosion does not have much effect on the quality of water? True or (False)

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Lesson 2

SOIL EROSION

In Lesson 2 you learned how moving water causes sheet, rill, and gully erosion. Soil is also moved from one location to another by the wind. Wind erosion is a greater factor in the Plains States, but it can be seen anywhere strong winds move across bare soil.

Answer these true or false questions to learn more about wind erosion. Place a "T" on the line if the question is true, or an "F" if the question is false.

_____ 1. Wind erosion is worse in forests than on the prairie.

_____ 2. Soils that are covered with many trees and other plants erode less often than soils without any vegetation.

_____ 3. Wind erosion is more likely to occur at high wind speeds.

_____ 4. Wind erosion is greatly affected by the amount of rainfall: the greater the rain, the greater the loss.

_____ 5. Some soils are more easily eroded by wind and water than other soils.

Write the answers to these two questions on the bottom of this activity sheet.

1. Where have you noticed the wind or water erosion in your community?

2. How did you know it was wind or water erosion?

Sheet, rill, gully, and wind erosion are four types of soil erosion. In the space below, place the four types of erosion in order. Begin with the largest problem in your area. End with the smallest problem in your area.

Largest Problem_____ _____Location of Problem

_____ _____

_____ _____

Smallest Problem_____ _____

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Lesson 2

SOIL EROSION

In Lesson 2 you learned how moving water causes sheet, rill, and gully erosion. Soil is also moved from one location to another by the wind. Wind erosion is a greater factor in the Plains States, but it can be seen anywhere strong winds move across bare soil.

Answer these true or false questions to learn more about wind erosion. Place a "T" on the line if the question is true, or an "F" if the question is false.

F 1. Wind erosion is worse in forests than on the prairie.

T 2. Soils that are covered with many trees and other plants erode less often than soils without any vegetation.

T 3. Wind erosion is more likely to occur at high wind speeds.

F 4. Wind erosion is greatly affected by the amount of rainfall: the greater the rain, the greater the loss.

T 5. Some soils are more easily eroded by wind and water than other soils.

Write the answers to these two questions on the bottom of this activity sheet.*

1. Where have you noticed the wind or water erosion in your community?

2. How did you know it was wind or water erosion?

Sheet, rill, gully, and wind erosion are four types of soil erosion. In the space below, place the four types of erosion in order. Begin with the largest problem in your area. End with the smallest problem in your area.*

Largest Problem_____ _____Location of Problem

_____ _____

_____ _____

Smallest Problem_____ _____

*Consider the community you are in, is it rural or urban? Erosion can occur in both areas. If urban, look at new building sites around town. Is silt entering any nearby streams or rivers? Remember wind erosion can be almost as much of a problem in an urban area as a rural area.

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Lesson 2

CONSERVING OUR SOIL

There are 10 words hidden in this puzzle. These words are listed below. Try to find as many as you can. You can circle them across, down, and diagonally. The letters of each word are always in order. Then use the correct word to fill in the blank in the sentences below.

N	O	N	B	W	O	R	M	S	A	N	D	Q	F	A	P
E	A	J	Z	U	A	R	P	O	I	M	F	E	K	T	B
X	H	T	G	T	D	P	O	L	L	U	T	I	O	N	E
C	L	R	V	U	I	P	C	E	N	E	R	Y	C	N	X
O	M	I	N	R	L	O	E	V	T	D	I	F	I	P	P
N	K	T	Z	I	A	T	V	G	A	H	R	M	Q	C	O
S	B	I	O	D	W	L	I	X	Q	G	A	I	L	O	R
E	X	S	L	F	Y	E	R	P	R	F	O	O	D	I	T
R	E	N	D	U	M	R	K	E	Y	U	S	Y	T	S	W
V	P	A	O	N	H	O	Z	F	S	R	K	P	B	A	N
A	L	L	T	G	O	S	U	Q	A	O	B	G	M	E	S
T	A	G	N	R	X	I	X	L	N	C	U	G	L	Y	H
I	N	V	A	P	L	O	Q	N	D	V	Z	R	E	W	C
O	T	P	E	Q	F	N	V	N	F	B	O	M	C	I	N
N	S	F	W	I	L	D	L	I	F	E	I	S	K	E	L
P	P	R	O	D	T	I	T	I	V	O	T	Y	C	M	S

a. conservation
b. food
c. pollution
d. erosion
e. ugly
f. wildlife
g. soil
h. worms
i. plants
j. sand

1. Severe soil erosion can lead to water _____.
2. Windbreaks and other soil conservation practices create homes for birds, rabbits, foxes, and other kinds of _____.
3. More than 40 years after the Dust Bowl era,_____ is still a national challenge.
4. Soil erosion can increase the price of the _____ that we eat.
5. Mudslides, gullies, and muddy water are _____ to look at.
6. Soil _____ helps save our soil.
7. _____ is a soil that does not stick together and has large grains.
8. Water and wind can carry away our _____.
9. _____ use sunlight to make food, help stop wind erosion and are good to eat.
10. _____ are one thing that lives in the soil.

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Lesson 2

CONSERVING OUR SOIL

There are 10 words hidden in this puzzle. These words are listed below. Try to find as many as you can. You can circle them across, down, and diagonally. The letters of each word are always in order. Then use the correct word to fill in the blank in the sentences below.

N	O	N	B	W	O	R	M	S	A	N	D	Q	F	A	P
E	A	J	Z	U	A	R	P	O	I	M	F	E	K	T	B
X	H	T	G	T	D	P	O	L	L	U	T	I	O	N	E
C	L	R	V	U	I	P	C	E	N	E	R	Y	C	N	X
O	M	I	N	R	L	O	E	V	T	D	I	F	I	P	P
N	K	T	Z	I	A	T	V	G	A	H	R	M	Q	C	O
S	B	I	O	D	W	L	I	X	Q	G	A	I	L	O	R
E	X	S	L	F	Y	E	R	P	R	F	O	O	D	I	T
R	E	N	D	U	M	R	K	E	Y	U	S	Y	T	S	W
V	P	A	O	N	H	O	Z	F	S	R	K	P	B	A	N
A	L	L	T	G	O	S	U	Q	A	O	B	G	M	E	S
T	A	G	N	R	X	I	X	L	N	C	U	G	L	Y	H
I	N	V	A	P	L	O	Q	N	D	V	Z	R	E	W	C
O	T	P	E	Q	F	N	V	N	F	B	O	M	C	I	N
N	S	F	W	I	L	D	L	I	F	E	I	S	K	E	L
P	P	R	O	D	T	I	T	I	V	O	T	Y	C	M	S

a. conservation
b. food
c. pollution
d. erosion
e. ugly
f. wildlife
g. soil
h. worms
i. plants
j. sand

1. Severe soil erosion can lead to water ___pollution___.
2. Windbreaks and other soil conservation practices create homes for birds, rabbits, foxes, and other kinds of ___wildlife___.
3. More than 40 years after the Dust Bowl era, ___erosion___ is still a national challenge.
4. Soil erosion can increase the price of the ___food___ that we eat.
5. Mudslides, gullies, and muddy water are ___ugly___ to look at.
6. Soil ___conservation___ helps save our soil.
7. ___Sand___ is a soil that does not stick together and has large grains.
8. Water and wind can carry away our ___soil___.
9. ___Plants___ use sunlight to make food, help stop wind erosion and are good to eat.
10. ___Worms___ are one thing that lives in the soil.

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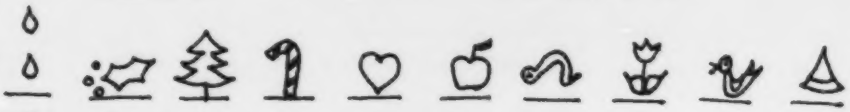
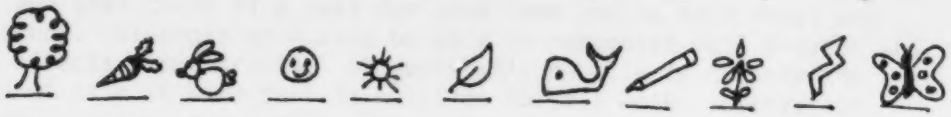
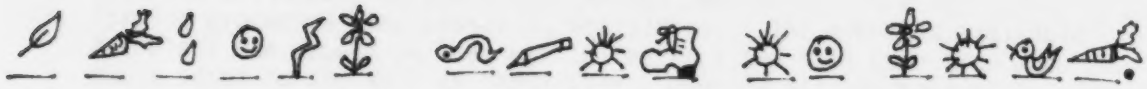
LESSON 2

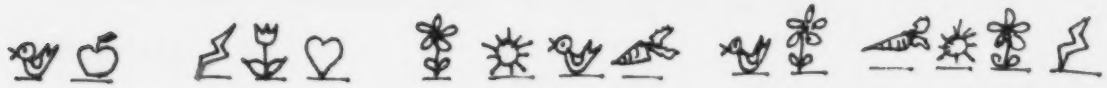
Handout 4

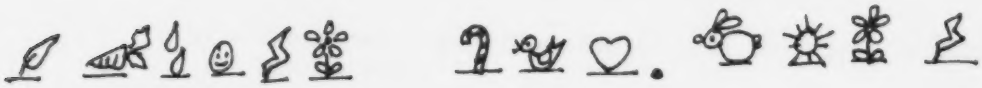
SOLVE THE MESSAGE BELOW BY WRITING THE LETTER OF EACH PICTURE CLUE THAT MATCHES THE SAME PICTURE IN THE ALPHABET.

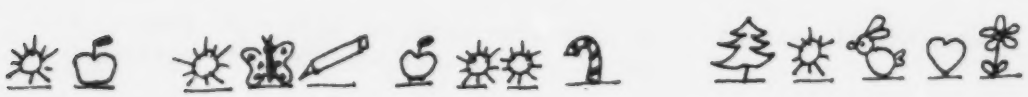


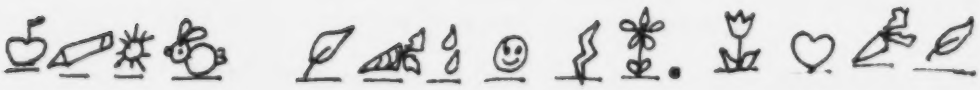


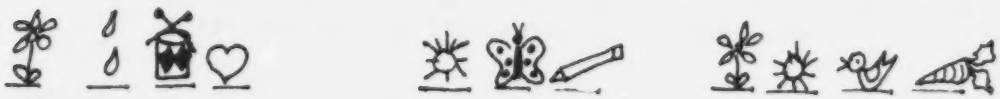












Lesson 3 - How Does Soil Affect Your Life?

OBJECTIVE:

Students will recognize that soils have different capabilities to grow plants and that there is a need for good land use in both rural and urban areas. Students will also be able to recognize soil erosion and how it affects plant growth. Students will be able to compare the effects of rain on bare soil in relation to soil with conservation measures.

Activity 1: Food From the Soil

Background:

Plants take their mineral nutrients from the soil. These minerals are made available for plant use through weathering and other soil-forming processes (See Lesson 1, Activity 1). The minerals available for plant use depend on what was in the rock the soil came from and those added to the soil as fertilizer. Over 1½ million tons of fertilizer are used in Kansas each year to grow crops. Man is dependent on the plants he cultivates for food. How well the plants grow is dependent upon the quality of the soil.

Materials:

The soil mixes developed in Lesson 1, Activity 2. If Lesson 1, Activity 2 was not completed, use the following soils:

- Clay - (obtained from hobby shop or clay soil area or commercial bentonite)*
- Sand - (obtain from lumber yard or sand company)*
- Silt - (obtain from overflow of flood area or any area where soil has been recently deposited by water)*

4 or more styrofoam or paper cups with holes punched in the bottom
1 package of seeds--radish, beans, or corn

Procedures:

1. Assign student groups to different soil types or mixtures. If soil mixtures from Lesson 1, Activity 2 are used, there will be more than the 4 mixes listed above.

2. Each group should obtain enough of their particular soil to fill an 8-ounce cup.

3. Before the soil is put into the cup, it should be thoroughly mixed and the cup labeled as to the soil name.

*Your local Soil Conservation Service office may be able to help you obtain soil materials.

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4. Plant two to three seeds in each cup and place near a light source.

5. Water each cup every day with 1 teaspoon of water.

6. Observe the germination of the plants and their growth for three to four weeks. Differences in growth and water needs will become evident as the plants mature. Use Attachment 1 to record your observations.

Discussion and interpretation can be obtained with the following questions:

1. Does the soil type affect how plants will grow in it?

2. Does the soil type change the amount of water needed to grow a plant?

3. Which soils and crops would benefit most from irrigation or extra water?

4. On what type of soil would you want to plant your garden?

5. Can one type of soil be changed to another type of soil? What would you add to a clay garden soil to make it looser and more easily tilled?

6. What is (are) the major type(s) of food produced in your area?

7. In your area, do farmers add nutrients such as fertilizer to the soil? If so, why?

8. Are there certain areas where no crops are grown? (Along major streams--flooding problems, excessively rocky or rough terrain).

Activity 1 (Cont.) Attachment 1

TYPE OF SOIL THE GROUP MADE _____

STUDENT OR STUDENTS IN GROUP _____

IS THE SOIL SMOOTH OR CRACKED?												
WATERED THE PLANT												
DID WATER RUN OUT OF THE BOTTOM OF THE CUP? (YES OR NO)												
DATE YOU FIRST SEE THE PLANT												

IN WHICH SOIL DID THE PLANT FIRST APPEAR? LAST APPEAR?

IN WHICH SOIL DID THE PLANT LOOK THE BEST?

IN WHICH SOIL DID THE PLANT LOOK THE WORST?

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Lesson 3 - How Does Soil Affect Your Life?

Other Disciplines:

Art

Pictures of "Dust Bowl"
Draw pictures of farm with good conservation

History

The "Dust Bowl"
Loss of farm and ranches

Math

Crop yields today versus crop yield in "Dust Bowl"
If soil weighs approximately 95 pounds per cubic foot, how much would be lost if one inch is eroded from a 10-foot square?

Social Studies

How wheat is processed into flour

Science

What happens to wildlife when the land erodes?

Lesson 3 - How Does Soil Affect Your Life?

Activity 2: Conservation of Soil and Water

Background:

In Kansas, we use the majority of our soils to grow crops. Sometimes we do not treat our soils with enough care so that they remain productive for crops in the future.

In the past, land was considered to be a resource that would never end. When a piece of land became unproductive, the farmers simply moved and settled on another piece of land. Finally in the 1930s, these types of farming practices led to blowing of billions of tons of soil commonly known as the "Dust Bowl". When the clouds of dust reached Washington, D.C., the Congress acted to stop the erosion by starting conservation programs under the direction of the Soil Conservation Service. Today, a part of the erosion problems has been corrected but much more still needs to be done. Conserving our soils will benefit all Americans by maintaining a resource which provides us food, as well as wildlife and a healthy environment in which to work and play.

Materials:

2 balls of yarn: one red, one green.
Construct the following signs (use imagination to decorate): punch 2 holes in signs and attach a small length of yarn so that students can wear around neck.

- 1 - Rain (12"x8") can be posted on chair or board
- 10 - Drop (6" circle)
- 2 - Plant (8"x4") for 2 students
- 1 - Conservation (8"x4")
- 10 - Soil (6"x3")
- 2 - Lake (8"x4") for 2 students
- 1 - Ocean (12"x8") can be posted on chair or board

Procedures:

The attached drawings show classroom set up and movements of students. Students who are the 10 "raindrops" move along paths as shown by the yarn down to the "ocean".

One group of 5 "raindrops" moves from the "rain" sign along the green yarn. They encounter a student wearing the "conservation" sign. They are let go one at a time, at intervals, to continue along the green yarn. Because they are slowed down or held back by the "conservation", they are not able to pick up or take the "soil" signs from around the feet of the student who is wearing the "plant" sign. They continue along the green yarn to the "lake" student where they are again held back for a short time. They then procede to the "ocean" sign at the far end of the green yarn.

Activity 2 (Cont.)

The other group of 5 "raindrops" moves from the "rain" sign along the red yarn. Since they do not encounter a student with a "conservation" sign, they are able to continue all together to the student with the "plant" sign. Since the "raindrops" came all at once, the "plant" student is not able to protect the "soil" signs at his or her feet. The "raindrops" each pick up a "soil" sign and continue along the red yarn to the "lake". When they encounter the student with the "lake" sign, they are held back for a short time. Since raindrops can only hold on to soil while they are moving, they must leave their "soil" signs at the "lake" before moving along the red yarn to the "ocean".

Two pint jars of water can be used to help explain this process. In one jar, have only water to represent the green line.* In the other jar, mix some soil with the water. Shake the jar to represent the water running to the lake on the red yarn side. When the jar is allowed to sit, the soil will settle out just like in the lake.

Discussion and Questions:

1. What held back the raindrops at the "Conservation" student?
2. What are some examples of conservation practices?
3. What is the loss of soil called? (Erosion)
4. On the green yarn side, what would happen if you removed the plants?
5. If you put lots of plants on the red yarn side instead of just one, could they better protect the soil from the raindrops?
6. What happens to plants that lose part of their soil?
7. How would the students like to swim or boat in the dirty lake? What would they do with it? Can the soil in the lake be reclaimed?
8. Which lake will have better fishing? The one on the green yarn or the one on the red yarn and why?
9. How can we keep from having erosion around the schoolyard and at home?

Explanations:

Conservation. The protection or improvement of soil, air, and water. Common conservation practices which protect soil from erosion include grass, dead plants (residue), terraces, and minimum tillage. See the local Soil Conservation Service office for pictures of these practices. Conservation practices which retard water for a short period of time can be illustrated by placing a sponge in a cup of water or in a trough of trickling water.

Erosion. The wearing away of soil by wind or water. See Lesson 2, Activities 1 and 2. A way to help explain erosion could be to cut a small styrofoam ball into 8 to 10 irregular shapes. Then take these pieces and put them back together with toothpicks. To explain erosion or wearing away, pull pieces off one at a time as they are acted on by wind and water.

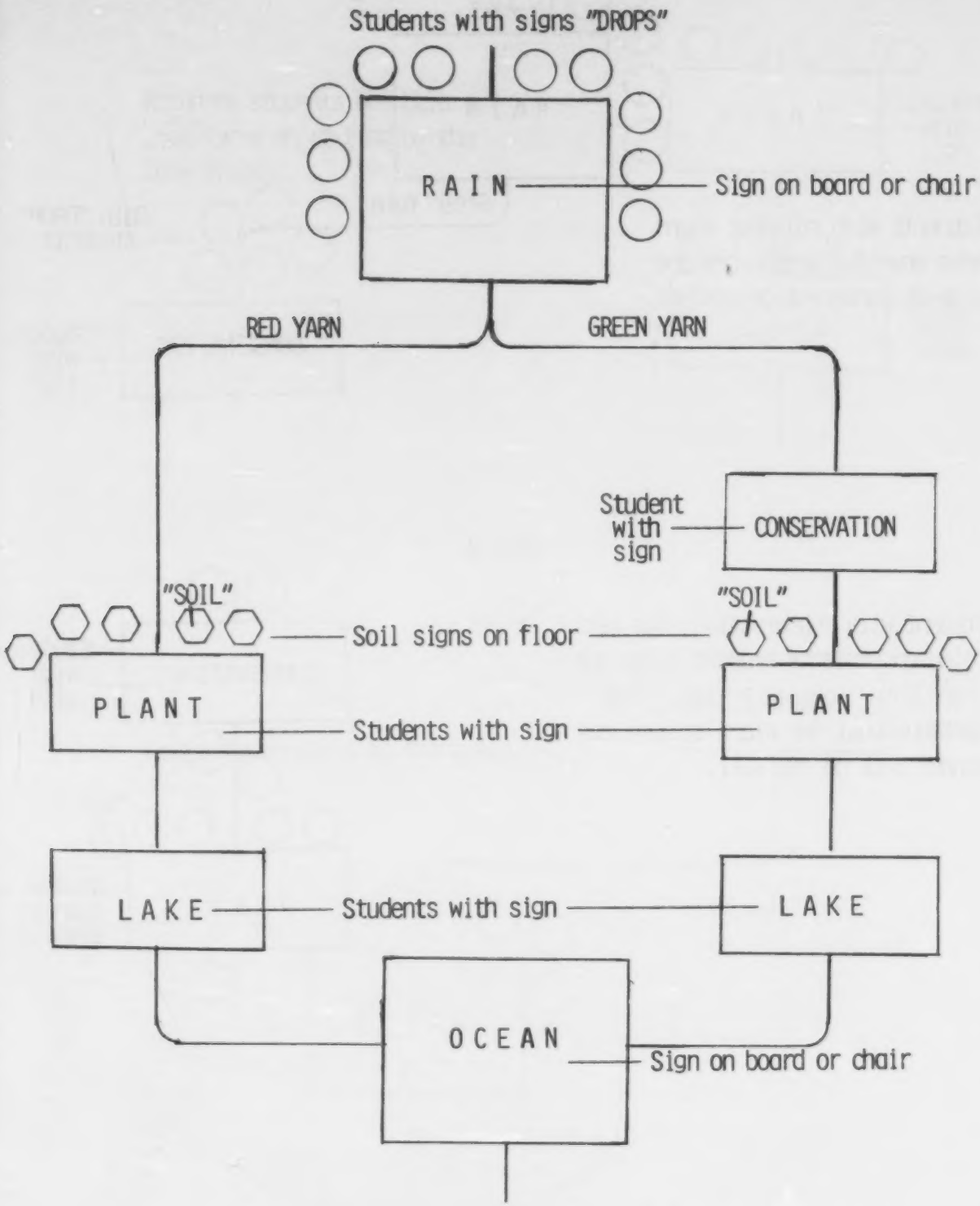
Terraces. An embankment or combination of an embankment and channel constructed across a slope to control erosion by diverting and temporarily storing surface runoff instead of permitting it to flow down the slope.

Minimum tillage. A practice which leaves the residue or dead plant from the previous crop on the surface at planting time.

Lesson 3 - How Does Soil Affect Your Life?

Activity 2 (cont.)

Attachment 1



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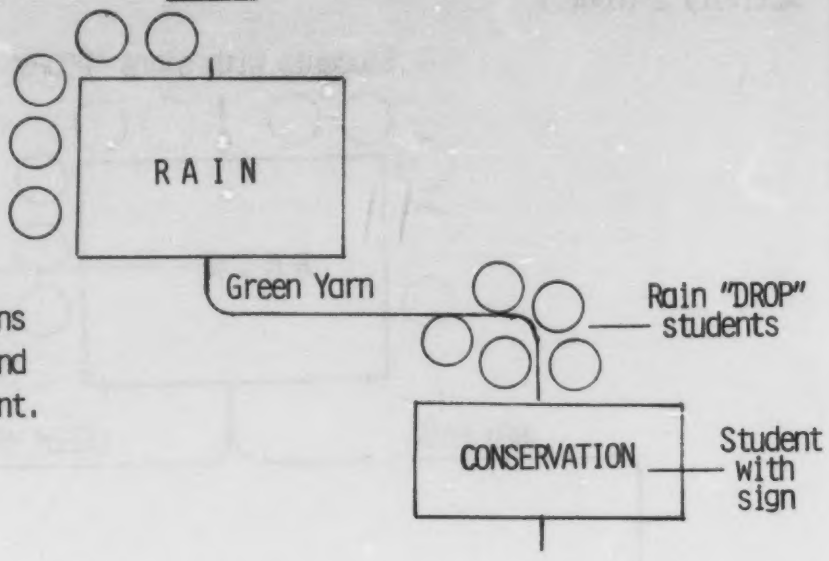
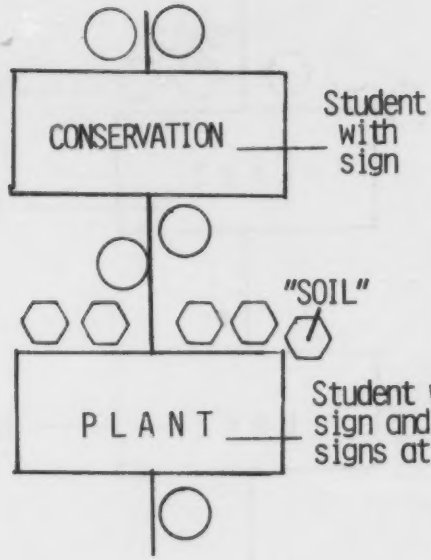
STEP 1



Students with raindrop signs move down the green yarn and stop at conservation student.

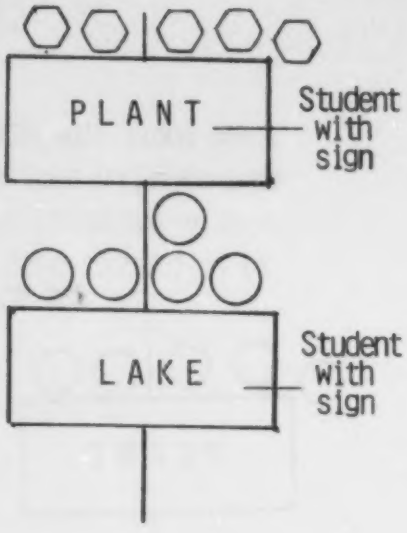
STEP 2



Student with conservation sign lets raindrop students proceed along the green yarn - <u>one at a time</u>. They continue past the plant student but cannot pick up any soil.

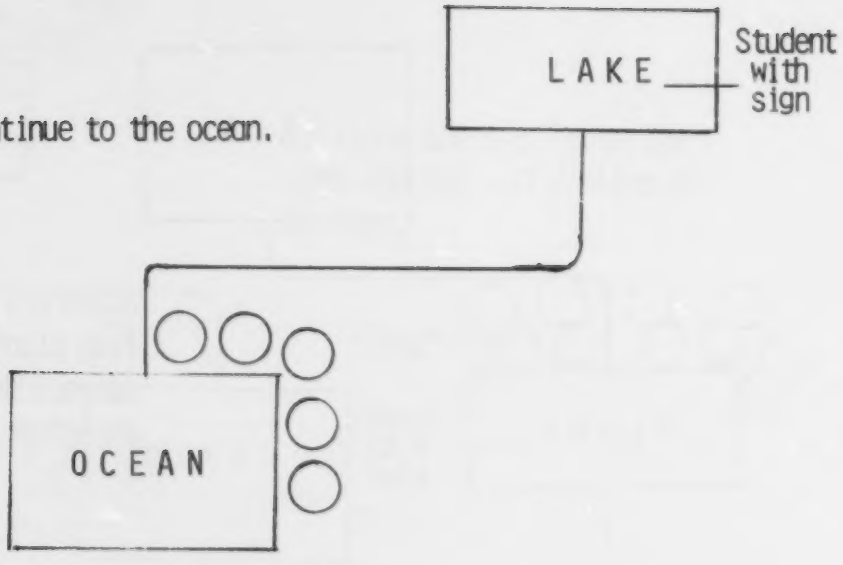
STEP 3

Raindrop students are held back for a short time by the lake student.

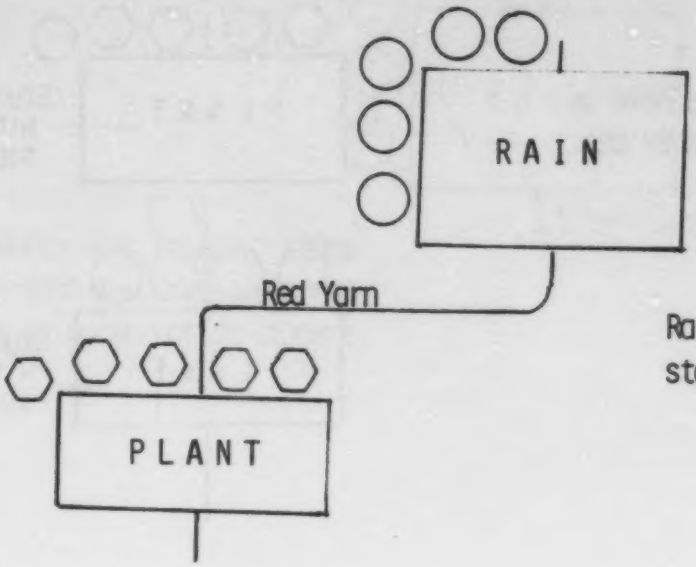


STEP 4

Raindrops continue to the ocean.

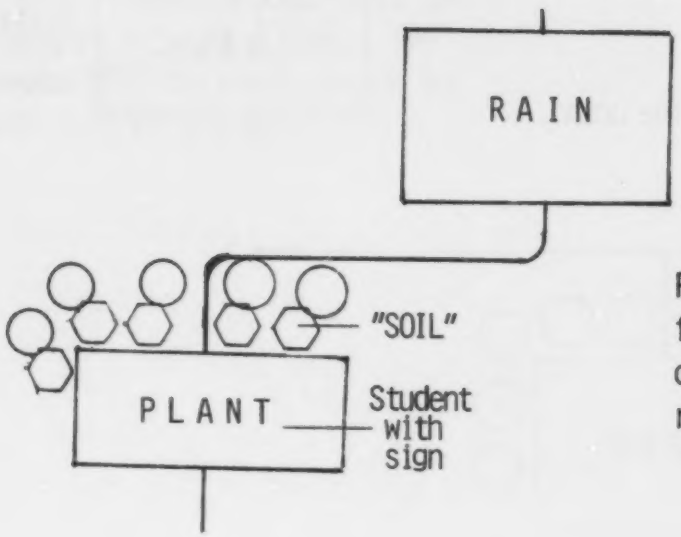


STEP 5



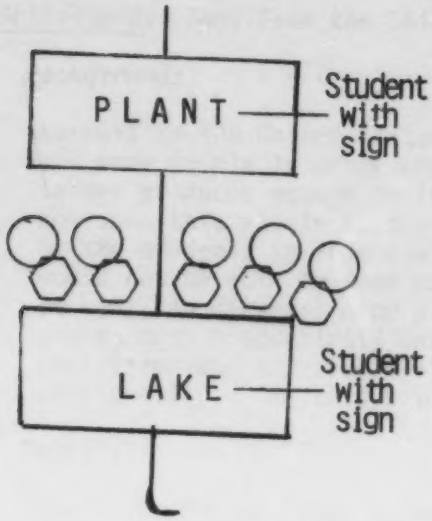
Raindrops, as a group, start along red yarn.

STEP 6



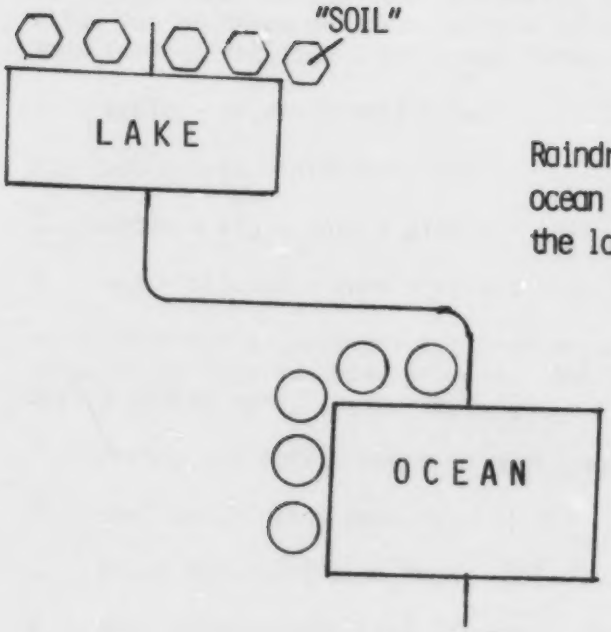
Raindrops pick up soil signs from plant who can't defend against the onslaught of raindrops.

STEP 7



Raindrops with soil signs are held back at lake and must drop their soil as raindrops must continue to move to hold on to their soil.

STEP 8



Raindrops continue on to the ocean and the soil remains in the lake.

Lesson 3 - How Does Soil Affect Your Life?

Activity 3: Food From the Soil

Background:

Farmers in the United States produce enough food to feed our country and many people in other countries as well. The average Kansas farmer produces enough to feed himself plus over 75 other people. How does this relate to the number of people in the families represented by the students in your class? Without the soil, Kansas farmers would not be able to feed the people. Even a loss of a few inches of soil can decrease crop yields significantly. Over the past 50 years, crop productivity has increased because technology such as fertilizer and improved varieties have overcome the reduction in soil quality. Can this situation continue into the future?

Materials:

Pictures of food items children bring from home (supplemented by you). Food chain picture chart (provided).

Procedures:

The day before the lesson, ask the children to bring a picture of one food item--a fruit, cheese, nut, meat, egg, etc.

At lesson time, display the foods with identifying names on cards. Allow two or three children to name their favorite food and lead them through the food's different forms back to the soil.

1. apple - tree - plants - soil
2. nut - tree - plants - soil
3. bacon - pig - corn - plants - soil
4. egg - chicken - corn - plants - soil

Using drawings or pictures cut from magazines, guide the children through the "egg to soil" process. Ask them to identify the figures with a naming word.

1. People eat eggs. Where do eggs come from? (Chickens)
2. What do chickens eat? (Corn)
3. Where does corn come from? (Plants)
4. What gives plants food to grow? (Soil)

Discussion and Other Ideas:

1. Ask students to identify beginning consonant sounds of the pictured food items and use consonant letters to spell beginning sounds.

2. Challenge them to classify and describe how the foods differ in shape, sizes, and colors.

3. Scramble the sequence of the food chain and ask students to arrange them in proper sequence.

4. Using the food item names, demonstrate upper and lower case form letters.

5. Have the students make up complete sentences using the food item names.

6. Combine two sets to describe the operation of addition.

7. Using the process of one-to-one correspondence, ask the students to construct sets of food items having more, fewer, and the same number of members.

8. Partition a given number of members in a set and identify the number remaining. Ask students to tell how many more members the larger set has.

9. Present the food chain with one item missing and ask students to identify the proper object to complete the pattern.

10. As it applies to the grade level, ask students to write complete sentences using describing words that tell how, when, and where. Then have them identify the subjects and predicates.

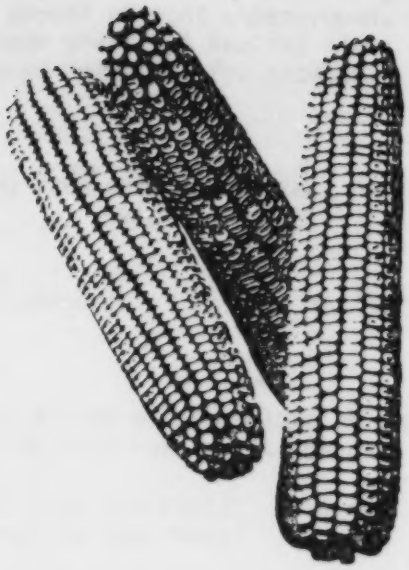
11. Using the same sentences, have them identify less common vowel sounds (pair, pear) (soil, boy).

12. Use the sentences to illustrate naming words and acting words.

13. Make a mobile of the "soil-food chains" using pictures cut from magazines, newspapers, and catalogs, and glued to cardboard.

Activity 3: (Cont.)

Attachment 1



Lesson 3 - How Does Soil Affect Your Life?

Activity 4: How Plants Save Soil

Background:

Plants help hold soil in place and prevent erosion. Grass plants are especially effective in preventing erosion not only by protecting the soil surface itself but also because of their extensive root systems. Root systems hold soil together and their annual growing and dying (up to 80 percent of the roots die each year) adds organic matter to the soil. It can be generalized that the amount of grass on top of the ground will equal the amount of root underground, so it is very important to properly manage grass. A healthy plant means a healthy root system and reduced potential for erosion.

Materials:

Plant with soil and roots (Can be dug from outside or use a house plant that is no longer wanted).
Seeds
Clear dish with cover
Cutting from house plant such as Philodendron

Procedures:

1. Take an unwanted potted plant or dig up a large clump of grass from outside, making sure that the soil remains attached.

   Carefully brush or wash the soil from the roots. Have the student notice how the soil clings to the roots.

2. After the roots are dry, spread them out on a large piece of paper and spray with paint. This will provide a picture of the roots.

   The total length of the roots can be measured and compared to the green part of the plant, if desired.

3. Seeds such as radishes and beans can be grown on a wet paper towel in a clean covered dish. The root hairs which will be visible can be used to demonstrate how roots hold soil particles. A cutting from a plant can also be used instead of seeds.

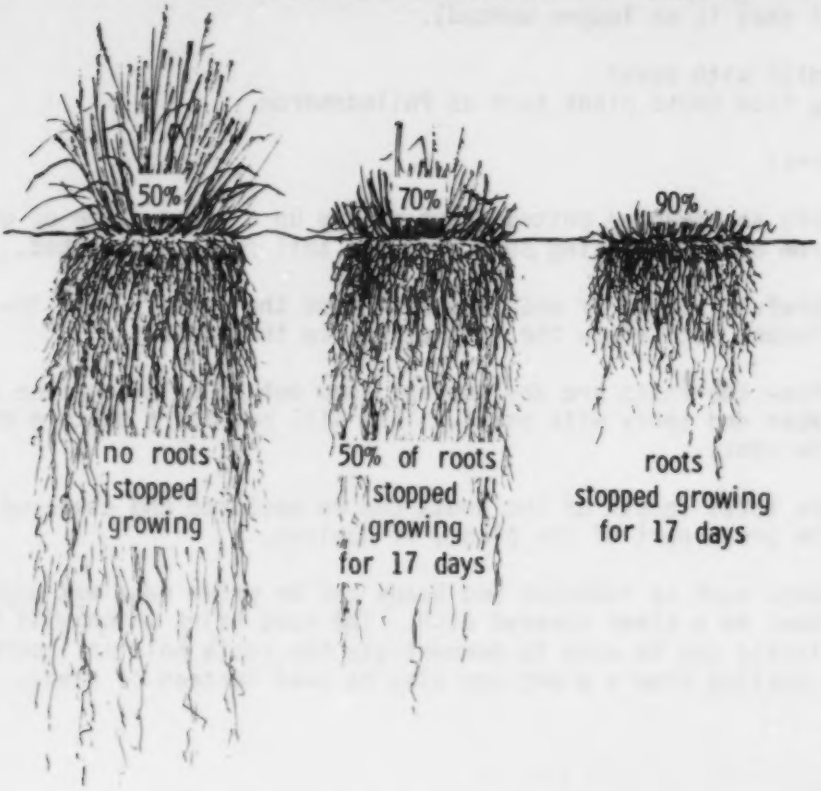
4. Teach the students to read the words soil, grass, and plant. Help them read the story and put the pictures in the correct order so that they match the story. Ask the questions:

   a. How does the grass keep the soil in place?

   b. What will happen if the cows eat too much of the grass?

   c. Where does the soil go when it washes off the field?

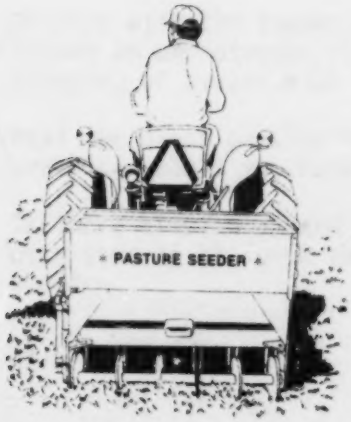
ROOT DEVELOPMENT IN RELATION TO TOP REMOVAL



Lesson 3 - How Does Soil Affect Your Life?

HOW PLANTS SAVE SOIL

1. THE GRASS IS GONE. NOW THE SOIL WILL BE LOST. 2. I WILL PLANT NEW GRASS. THIS WILL SAVE THE SOIL. 3. SEE THE COWS EAT THE GRASS. 4. LIKE GRASS TO EAT.



Lesson 3 - How Does Soil Affect Your Life?

Activity 5: Conservation Farming

Background:

The quality of our soils can be reduced by our actions. Soil loss usually occurs because people do not understand soils or how to protect them. Often poor decisions are made for economic or other reasons and soils cannot support the new land use without damage to the soil resource.

When a farmer removes a crop from a field, the soil can erode if not protected from runoff and wind. A bare plowed field left without plant cover will erode more rapidly than one with some of the last crop left on the surface of the ground.

After soil is eroded, farmers must spend more time and money to raise crops on the poorer soils. This can affect all of us since food is so important to the world and is our largest export commodity. We must carefully protect our soils and conserve our agricultural land.

Materials:

Attached Activity Page (reproduce for class)

Procedures:

1. Have the students complete the activity sheet on conservation farming.

2. Discuss with the students how soil loss and farming are related.

   a. Will the loss of soil affect crop production?
   b. If crops are reduced, what will happen to prices of food?
   c. Can soil erosion cost you more money for food?

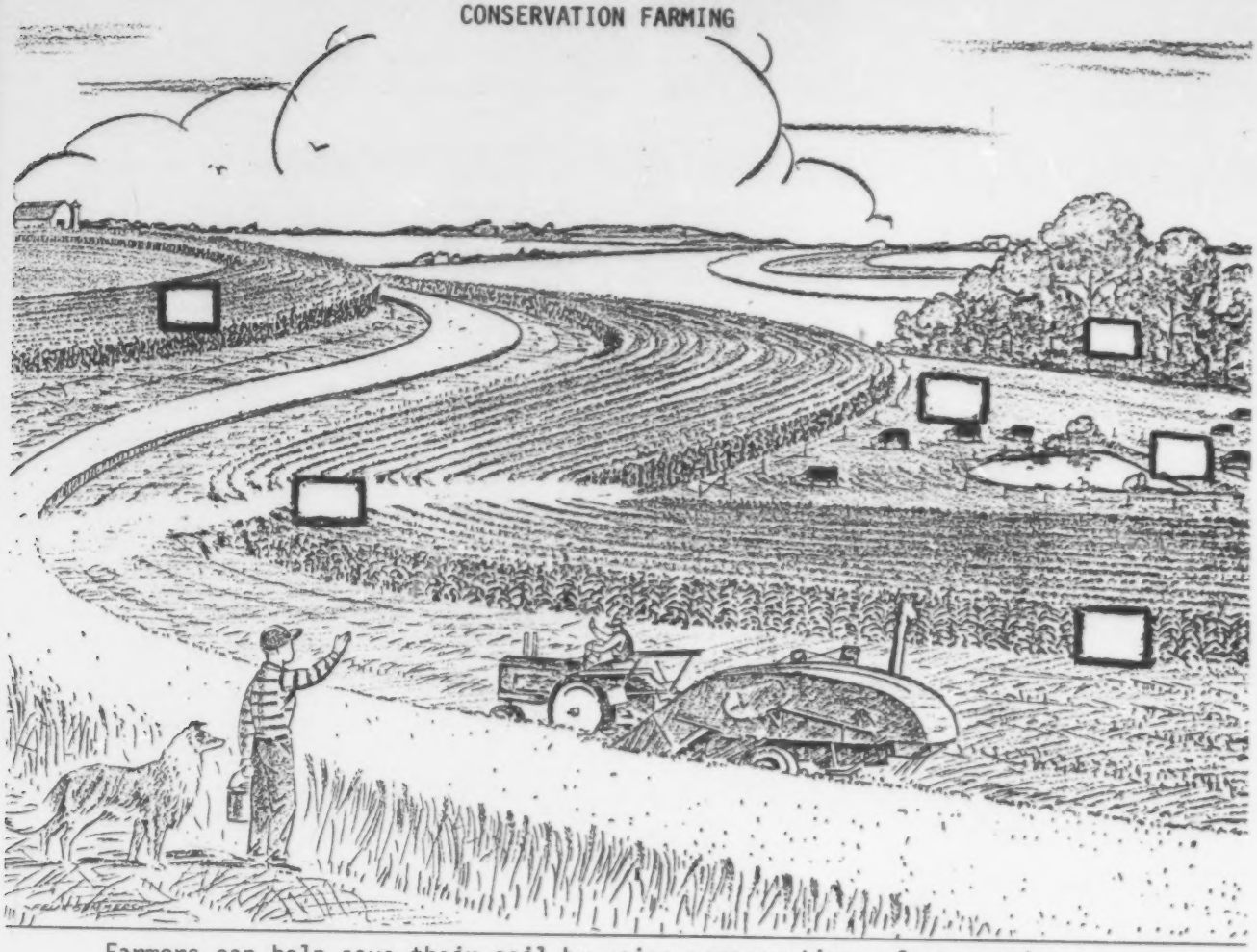
3. Discuss with the students what will happen to the soil that leaves an unprotected field, and what extra costs such as dredging of rivers will incure.

4. Have the class develop their own farm plan. What conservation practices would you have? What crops would you grow?

5. Is there erosion around your city and school? Can it be cured with some of the same conservation practices that the farmer used?

Lesson 3 - How Does Soil Affect Your Life?

CONSERVATION FARMING



Farmers can help save their soil by using conservation. Conservation not only reduces soil loss but also helps farmers grow better crops.

Match the following conservation practices with the above picture by placing the number of the conservation practice in the correct box in the picture.

1. Contour Farming: Planting crops around the hill rather than up and down.

2. Waterway: A grass strip which runs down the hill to carry water from the field.

3. Pond: An area where water is stored for a short time.

4. Terrace: A wide ridge that goes around the hill and brings the water to the waterway.

5. Windbreak: A planting of trees to keep the wind from blowing the soil away.

6. Grassland: Grassy areas keep soil in place as well as provide hay and grazing for cows.

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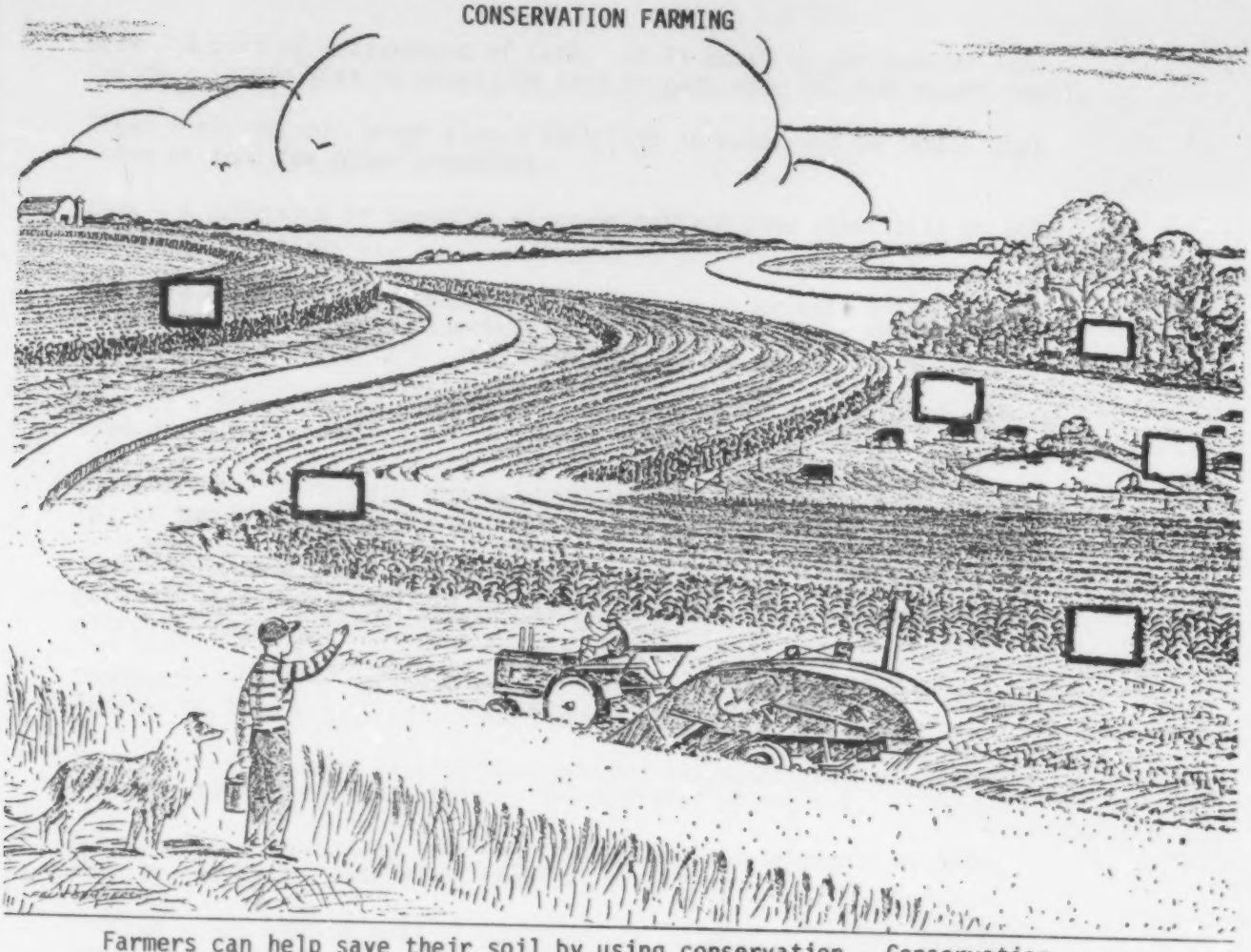
Lesson 3 - How Does Soil Affect Your Life?

CONSERVATION FARMING



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CONSERVATION GLOSSARY

Acre - A unit of measurement of land. It is equal to the area of land inside a square that is about 208 feet on each side (43,560 square feet).

Algae - Microscopic green plants that live in water and on land. They serve as food for other organisms.

Alum - A potassium or ammonium aluminum sulfate used especially as an astrigent and styptic.

Bacteria - Microscopic organisms that live on water and on land. They help break down organic materials into simpler nutrients in a process called decay. Bacteria release nutrients to the soil.

Bedrock - A more or less solid layer of rock found on the surface of the land or below the soil.

Biochemical - Of or relating to biochemistry; characterized by, produced by, or involving chemical reactions in living organisms.

Carbon Dioxide - A colorless, odorless, nonpoisonous gas that forms carbonic acid when dissolved in water, produced during combustion and microbial decomposition.

Composting - Mixing decaying organic matter (food scraps, grass clippings, leaves) to form a rich soil conditioner.

Conservation - Saving by wise use; planned management of a material resource to prevent exploitation, destruction, or neglect.

Decomposing - Separating into constituent parts of elements or into simpler compounds, undergoing chemical breakdown.

Erosion - The wearing away of land surface by wind or water. Erosion occurs naturally from weather or runoff but is often intensified by man's practices.

Flood plain - Nearly level land situated on either or both sides of a channel that is subject to overflow flooding. Lowland and relatively flat alluvial areas adjoining inland waters.

Fungi - Small simple plants that lack chlorophyll. The individual cells have a nucleus surrounded by a membrane, and they may be linked together in long filaments called hyphae, which may grow together to form a visible body. Simple fungi are useful in stabilizing solid waste and sewage.

Habitat - An area of land in which plants and animals live, grow, and reproduce.

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Humus - Highly decomposed plant and animal material that is a part of soil.

Hydrologic Cycle - The cycle of water movement from the atmosphere to the earth and back again through these steps; evaporation, transpiration, condensation, precipitation, percolation, runoff, and storage.

Immunity - A condition of being able to resist a particular disease, through preventing development of a pathogenic microorganism or by counteracting the effects of its products.

Inert - Lacking the power to move; lacking a usual or anticipated chemical or biological action; very slow to move or act.

Inorganic - All chemical compounds in nature, except the compounds of carbon, but including the carbonates.

Land - One of the major factors of production that is supplied by nature and includes all natural resources in their original state such as mineral deposits, wildlife, timber, fish, water, and the fertility of the soil.

Lime - From the strictly chemical standpoint, refers to only one compound, calcium oxide (CaO); however, the term is commonly used in agriculture to include a great variety of materials that are usually composed of the oxide, hydroxide, or carbonate of calcium or of calcium and magnesium; used to furnish calcium and magnesium as essential elements for the growth of plants and to neutralize soil acidity. The most commonly used forms of agricultural lime are ground limestone (carbonates), hydrated lime (hydroxides), burnt lime (oxides), marl, and oyster shells.

Limestone - A sedimentary rock composed of calcium carbonate, $CaCO_3$. There are many impure varieties.

Microbial - Pertaining to a group of microorganisms (germs).

Microorganisms - Those minute organisms invisible or only barely visible to the unaided eye.

Millipedes - A small crawling animal; any numerous myriopods (class Diplopoda) having usually a cylindrical segmented body, two pairs of legs on most apparent segments, and no poison fangs.

Mineralization - The conversion of an element from an organic form to an inorganic state as a result of microbial decomposition.

Minimum Tillage - Raising crops with small amounts of soil disturbance. Most of the residue from the previous crop is left on the surface.

Mineral - A natural inorganic substance that possesses a definite chemical composition and definite physical and chemical properties.

Mineral Nutrients - Elements, or compounds, essential as raw materials for organism growth and development, such as carbon, oxygen, nitrogen, phosphorus, etc. The dissolved solids and gases of the water of an area.

Mold - A superficial often wooly growth produced on damp or decaying organic matter or on living organisms.

Nutrient - A substance that supplies nourishment for an organism to live. It can be food or chemicals depending upon the organism.

Organic Matter - Plant and animal material in various stages of decomposition that may be part of the soil.

Parent Material - The earthy materials--both mineral and organic--from which soil is formed.

Percolation - The downward movement of water in soil.

Permeability - The quality of soil that allows air or water to move through it.

Pore Spaces - The area of the soil through which water and air move. The space between soil particles.

Residue - Material that remains after gases, liquids, or solids have been removed.

Sandstone - A sedimentary rock consisting of usually quartz sand united by some cement (as silica or calcium carbonate).

Soil - A naturally occurring mixture of minerals, organic matter, water, and air which has a definite structure and composition and forms on the surface of the land. A kind of soil is the collection of soils that are alike in specified combinations of characteristics. Kinds of soils are given names in the system of soil classification. The terms "the soil" and "soil" are collective terms used for all soils, equivalent to the word "vegetation" for all plants.

Soil Horizon - A layer of soil that is nearly parallel to the land surface and is different from layers above and below.

Soil Mantle - The soil that covers the earth's surface, such as a carpet would cover a floor. This is the top layer that covers the surface.

Soil Survey - A general term for the examination of soils in the field and in laboratories; their description and classification; the mapping of kinds of soil; the interpretation of soils according to their adaptability for various crops, grasses, and trees; their behavior under use or treatment for plant production or for other purposes; and their productivity under different management systems.

Soluble - Susceptible of being dissolved in or as if in a fluid. Capable of being loosened or dissolved.

Terrace - A soil conservation practice in which ridges or steps are built on slopes to slow down runoff and increase soil moisture.

Texture - The relative proportions of the various soil separates in a soil as described by the classes of soil texture.

Waterway - A grassed linear strip used to convey water from crop fields so that runoff does not cause erosion.

Weathering - The disintegration and decomposition of rocks and other earth materials through exposure to the atmosphere; one of the major factors in soil formation.

Windbreaks - A living barrier of trees or combination of trees and shrubs located adjacent to a farmstead, field, feedlot, or other area to protect soil resources; reduce wind erosion; conserve energy or moisture; control snow deposition; provide shelter for livestock or wildlife; or increase the natural beauty of an area; also called field windbreak, feedlot windbreak, or farmstead windbreak, depending upon the intended use.

TEACHERS EVALUATION OF
"CONSERVING OUR SOIL RESOURCES" LESSON PLANS

1. Can you see a use for this information in your class?

   Yes No

2. Was the material organized in a manner which you could work with?

   Yes No

   If no, the Soil Conservation Service should review the following:

3. Was the background information adequate?

   Yes No

   If no, which lessons needed additional information?

4. Is an emphasis on other disciplines or how they could be incorporated to help teach about soils and conservation beneficial?

   Yes No

5. Activities you have used to this date:

6. Do you anticipate using this in your future lesson plans?

   Yes No

7. Changes you might suggest to improve this package (please include specific problems you may have encountered):

8. May our local Soil Conservation Service representative contact you at a future date for follow-up on this exercise?

   Yes No

_____ Grade you teach _____
Signature

Mailing Address:

_____

_____

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